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ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

## Ten-Year Growth of Two Sources of Large Grade Ponderosa Pine Transplants in Nebraska

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*In a 10-year-old plantation of ponderosa pine in north-central Nebraska, the large grade 2+1 stock from a Rosebud seed source grew faster than the same size and age class from a Niobrara seed source. Large grade stock of both seed sources survived better and grew faster than ungraded bedrun stock.*

A small study involving two seed sources and three age classes of graded and ungraded ponderosa pine planting stock was established in Nebraska in spring 1954. First-year survival for the graded versus ungraded stock was reported earlier.<sup>2</sup>

One of the plantations in this study, which has developed normally on a sandy loam site in Holt County, (north-central) Nebraska, was measured for survival and height growth after 5 and 10 years. These data are reported in this Note, because of the particularly interesting results regarding growth of trees from the two seed sources.

The two sources of ponderosa pine seed are known as Rosebud and Niobrara. The Niobrara stands (from which these seed lots originated) are on the breaks of the Niobrara

River near Valentine, Nebraska, 90 miles due west of the study plantation. The Rosebud stands are in the breaks of the Little White River in Todd County, South Dakota, about 30 miles northwest of the Niobrara source stands. The two sources are not continuous; they are separated by 30 miles of treeless sandhills. Recent collections of ponderosa pine material from these two areas have revealed distinct differences in some taxonomic characteristics such as needle length, number of needles per fascicle, cone size, and color of seed wings and cone scales. Distinct genetic differences in the two stands are strongly suggested.

All planting stock was grown at Bessey Nursery, operated by the U. S. Forest Service near Halsey, Nebraska. The Rosebud source in this study was represented by 2 + 1 and 1 + 2 age classes, and the Niobrara source by 2 + 1 and 2 + 1 + 1. A large grade of stock was selected from the bedrun lots of each age class, and was approximately the largest one-third of transplants on the basis of stem caliper (8/32 to 15/32 inch), top size, and root size. Ungraded, bedrun material was represented only by 2 + 1 Niobrara stock. The field planting consisted of two rows with 25-tree linear plots of each class of stock randomly located within each of two blocks.

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<sup>2</sup> Read, Ralph A. Grading of transplants may improve initial survival of ponderosa pine in Plains windbreaks. U. S. Forest Serv. Rocky Mountain Forest and Range Exp. Sta., Res. Note 16, 2 pp. 1955.

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Typical specimens of the large grade of each age class and source are shown in figure 1. Although the 1+2 Rosebud transplants were largest, they were not the best. Well over half of this stock had damaged roots. Two consecutive years at 1-1/2-inch spacing in the transplant bed made it virtually impossible to separate these trees without stripping the roots. This alone probably accounted for the high first-year mortality of 1+2 Rosebud. Transplants of other age classes were separated easily without damage.

Survival and growth data are given in table 1. Significant differences between means in the following discussion were obtained by "t" tests.

There was no change in survival between the second and tenth years. All mortality occurred the first growing season. This emphasizes the importance of using high quality stock for attaining greatest survival and growth the first growing season. Differences in 10-year survival among the large grades of 2+1 and 2+1+1 stock were not significant. Survival of these large grade trees was far

superior to that of ungraded, bedrun stock. The 66 percent survival of large grade 1+2 Rosebud stock was explained above; there were no losses of this material after the first year.

The only significant difference in height after 5 years was between the ungraded 2+1 Niobrara stock, which averaged 1.7 feet, and all large grades of the different age classes and sources, which averaged 3.0 feet. Thus the advantage gained in early height growth by using large grade stock is apparent.

Differences in total height among seed sources and classes of stock after 10 growing seasons are of special interest. In the large grade 2+1 category, the Rosebud source averaged 10.3 feet, while the Niobrara source averaged only 7.7 feet. Moreover, the survivors of the large grade 1+2 class of Rosebud outgrew the 2+1 Niobrara source (respectively, 9.4 feet and 7.7 feet). The 2+1 Rosebud trees, which were incidentally the smallest of the graded stock (fig. 1), averaged 1.42 feet height growth per year during the past 5 years.



Figure 1.--Representative specimens of ponderosa pine planting stock used in the study.  
R = Rosebud source, N = Niobrara source.

Table 1. --Survival and height growth of two sources and three age classes of graded and ungraded ponderosa pine transplants in north-central Nebraska

Source, age class, and grade	Average height			Range in total height	Average annual height growth (last 5 years)	10-year survival	Basis: trees
	Planting stock	After 5 years	After 10 years				
----- <u>Feet</u> -----						<u>Percent</u>	<u>No.</u>
NIOBRARA:							
2 + 1 Ungraded, bedrun	0.5	1.7	4.7	1- 9	0.60	51	54
2+1 Large grade	.7	2.9	7.7	5-10	.96	90	44
2+1+1 Large grade	.9	3.0	9.9	6-13	1.38	92	46
ROSEBUD:							
2 + 1 Large grade	.6	3.2	10.3	7-14	1.42	98	49
1 + 2 Large grade	1.0	3.0	9.4	3-12	1.28	66	33

Of the large grade Niobrara stock, the 2 + 1 + 1 transplants were significantly taller after 10 years than the 2 + 1 transplants (respectively, 9.9 feet and 7.7 feet). Although little difference in height was evident at 5 years' age, the trees developing from 2 + 1 + 1 stock are now growing almost 50 percent faster than trees from the 2 + 1 age class. They are, of course, 1 year older.

Average height of trees from large grade 2 + 1 Niobrara stock was significantly greater than that of trees from ungraded, bedrun 2 + 1 Niobrara stock (respectively, 7.7 feet and 4.7 feet). Although the maximum heights of graded and ungraded trees were about the same, the ungraded portion of the planting contains many shorter trees.

As a possible explanation for the differences in height growth rate of Rosebud and

Niobrara sources, taxonomic data collected from 10 seed trees in each area in 1963 show:

	<u>Niobrara</u>	<u>Rosebud</u>
Number of trees predominately		
2-needle	7	3
3-needle	3	7
Average number of needles per fascicle	2.4	2.7
Length of needles (mm.)		
Average	179	209
Range	152-216	181-234

The greater vigor and height growth of the Rosebud source may thus be associated with a higher proportion of progeny having a greater photosynthetic area produced by 3-needle fascicles containing needles over an inch longer than the Niobrara trees.

